Watch Out for the Beast: Fear Information and Attentional Bias in Children

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Abstract

Although valenced information about novel animals changes the implicit and explicit fear beliefs of children (Field & Lawson, 2003), how it might lead to anxiety is unknown. One possibility, based on cognitive models of anxiety, is that fear information creates attentional biases similar to those seen in anxiety disorders. Children aged between 7 and 9 were given positive information about one novel animal, negative information about another and no information about the third. A pictorial dot-probe task was used, immediately or with a 24 hour delay, to test for attentional biases to the different animals. The results replicated the finding that fear information changes children's fear beliefs. Regardless of whether there was a delay, children acquired an attentional bias in the left visual field towards the animal about which they held negative beliefs compared to the control animal. These results imply a possible way in which fear information might lead contribute to acquired fear.

Watch out for the beast: fear information and attentional bias in children

Cognitive explanations of anxiety suppose that high level cognitive processes cause and maintain the anxiety. Indeed, cognitive biases appear to be an important part of the aetiology of all anxiety disorders (see Field, 2003). Mathews & MacLeod (2002) describe a model based on Williams, Macleod, Watts & Mathews (1997) in which stimuli compete for limited attentional resources: attention gained by one stimulus decreases attention to the other through inhibitory connections. If a stimulus matches information associated with threat, Mathews and MacLeod propose that it will receive greater activation from a threat evaluation system and, therefore, greater attention (and increased sensations of anxiety). The threat evaluation system can be inhibited by controlled processing, however, when task demands become too great (such as in states of stress) controlled processing fails and the threat evaluation system takes hold resulting in more threat-information entering awareness. Similar ideas underpin other models of anxiety such as Eysenck's hypervigilance model (1992) and Öhman and Mineka's (2001) model of phobia acquisition.

There is a plethora of evidence for relationships between anxiety and attentional bias in adults in animal phobia (Watts, McKenna, Sharrock, & Trezise, 1986), social phobia (Mattia, Heimberg, & Hope, 1993; Mogg & Bradley, 2002), obsessive compulsive disorder (Foa & McNally, 1986), panic (McNally, Reimann, & Kim, 1990b) and post-traumatic stress disorder (McNally, Kaspi, Reimann, & Zeitlin, 1990a) and generalized anxiety disorder (Mathews & MacLeod, 1985; Bradley, Mogg, White, Groom, & de Bono, 1999; Mogg, Mathews & Weinman, 1989) and with pictures as well as words (e.g. Bradley, Mogg, Falla, & Hamilton, 1998; Bradley et al., 1999; Mogg & Bradley, 2002; Mogg, Bradley, Miles & Dixon, 2004). Despite this research, there is little evidence regarding the direction of causality (Mathews & Mackintosh, 2000): does anxiety cause the cognitive bias, does the bias cause anxiety, or does

some extraneous variable cause both the anxiety and the cognitive bias? Mathews and Mackintosh (2000) and Mathews & Macleod (2002) addressed this question in several innovative studies in which cognitive biases were induced (through training using verbal material) and the effect on anxiety observed. They demonstrated that cognitive biases could be induced and were causally responsible for increases in state anxiety. The implications of this work to fear development are clear: attentional biases to threat can be learned by non-anxious individuals, and acquiring such a bias increases anxiety. As such, normal children may become anxious as a result of acquiring persistent attentional biases that drive anxious responding.

If acquired attentional biases offer a causal mechanism for the development of anxiety then how might such biases develop in children? Even though recent research has shown that attentional biases are associated with trait anxiety in children (Schippell, Vasey, Cravens-Brown, & Bretveld, 2003; Bijttebier, Vasey & Braet, 2003, Vasey, Daleiden, Williams, & Brown, 1995), there is a noticeable lack of research investigating from where these biases come (Vasey & MacLeod, 2001). In general, the mechanisms underlying the development of fears have been neglected because of the ethical issues associated with prospective studies of fears in children. However, in many of the paradigms used by Mathews and his colleagues, verbal information or statements were used to induce attentional biases and verbal information has long been considered a pathway to fear (Rachman, 1977).

Extensive reviews (see King, Gullone & Ollendick, 1998; and Merckelbach, De Jong, Muris, & van den Hout, 1996) have concluded that there is support for fear information as a pathway to fear. For example, children who report a lot of fear to items on the Fear Survey Schedule for Children—Revised (FSSC—R) will often attribute their fear to negative information (Ollendick & King, 1991), and negative information can sometimes be the most prominent of the three pathways (Ollendick &

King, 1991; Muris, Merckelbach, Gadet & Moulaert, 2000). More recently, support for the information pathway to fear has come from prospective paradigms: Field, Argyris and Knowles (2001) conducted two experiments in which 7–9 year olds received either positive or negative information about previously un-encountered toy monsters. Their results demonstrated that children's fear beliefs towards the monster about which they'd received negative information significantly increased. Muris, Bodden, Merckelbach, Ollendick, & King (2003) replicated these findings and showed that the effect of negative information persisted a week after it was given. Field and Lawson (2003), extended this paradigm to look at fears of real animals by using Australian marsupials (the quoll, quokka and cuscus), that were unfamiliar to children in the UK, as stimulus materials. For a particular child, one of the animals was associated with positive information, one was associated with negative information and they were given no information about the third. In these studies, negative information significantly increased children's fear beliefs both when measured explicitly with self-report measures, and also when measured implicitly using an adapted version of the Implicit Association Task (IAT, Greenwald, McGhee & Schwartz, 1998). In addition, Field and Lawson showed that children were more reluctant to place their hand in a box claiming to house the animal about which they had received negative information. Field et al. (2003) have also shown that negative information can change beliefs about social situations in children using a similar paradigm. These effects also appear to be independent of trait anxiety: in all of these studies trait anxiety (as measured by the FSSC—R, Yule, 1997) has not moderated the effects of fear information.

However, there is an important jump to be made in explaining how fear information might then lead to anxiety. We know that extensive training using verbal information can be used as a tool to induce attentional biases about non-novel situations and that such biases lead to increases in anxiety; we do not know whether

short episodes of fear-relevant information about novel stimuli can have similar effects (that is, induce the kinds of attentional biases that have been shown to causally affect anxiety). Demonstrating that fear information about novel stimuli can induce attentional biases in children is, therefore, an important step in untangling the causal mechanism underlying the development of anxiety in normal children.

The purpose of this study is to see whether negative information in childhood is sufficient to create an attentional bias towards negative material by using a visual dot-probe task. Unlike the IAT task used in previous studies, the visual dot-probe task is designed to measure directly how visual attention to competing stimuli is distributed (Macleod, Mathews & Tata, 1986). The IAT does not measure visual attention but does gauge of the strength of association between different concepts (De Houwer, 2002). For example, in Field and Lawson (2003), the IAT measured the strength of association between the concepts of 'Quoll', 'Quokka' or 'Cuscus' and the concepts of 'nice' and 'nasty', but did not indicate the attention paid to those concepts or the processing resources allocated to them. As such, the IAT can be used to infer beliefs indirectly, but does not enable conclusions about the visual resources allocated to different stimuli. Using the dot-probe task in this experiment takes moves this research paradigm forward in an important respect: it enables conclusions about the effects of verbal information on attentional resources, and conversely, will inform us about whether verbal information is a plausible mechanism through which the attentional biases shown to create anxiety (e.g. Mathews & MacLeod, 2002) develop in normal children. If negative information does have a causal role in promoting attentional biases then we would expect children to have a tendency to look at animals about which they have been given negative information in preference to looking at (control) animals about which nothing is known.

Method

Participants

Fifty children took part in this experiment. In the No Delay Group there were 23 (7 males and 16 females) children aged between 8 and 10 years old (M = 8.95, SD = 0.57). In the delay group there were 27 children (15 males and 12 females) aged between 8 and 10 (M = 10.05, SD = 0.22). Although children were randomly allocated to the two groups the ages in the two groups were significantly different, $t(48) = -9.32$, $p < .001$. Two additional children completed the experiment but due to a large number of errors in the dot-probe task their data could not be analysed. All children were recruited from a primary school in East Sussex, UK. Informed consent was obtained from parents prior to the study.

Materials

Animals

Pictures of three Australian marsupials, the Quoll, the Cuscus and the Quokka were used. These were animals about which the children had no prior experience and so they would have no prior fear expectations.

Information

The two sets of information (one positive, one negative), approximately matched for length and word frequency, used by Field & Lawson (2003) were used (Appendix A).

Fear Beliefs Questionnaire (FBQ)

The FBQ used by Field & Lawson (2003) was used: this consists of 21 statements (7 repeated once for each animal) about the animals each with a 5-point Likert response scale (Appendix B). This resulted in a fear belief score for each animal that could range from 0 (no fear belief) to 4 (complete fear belief). Cronbach's αs for the

subscales were .87 (Cuscus subscale), .86 (Quokka subscale) and .84 (Quoll subscale) before the information, and .98 (Cuscus subscale), .98 (Quokka subscale) and .97 (Quoll subscale) after the information. These values are consistent with other studies from out laboratory using this scale: some examples, α = .82, .74, .70, .74 (Cuscus subscale), .78, .69, .71, .68 (Quokka subscale) and .81, .66, .79, .69 (Quoll subscale) before information and α = .98, .90, .87, .87 (Cuscus subscale), .98, .93, .87, .84 (Quokka subscale) and .98, .95, .88, .89 (Quoll subscale) before information.

The Visual Dot-Probe Task

An adapted version of the pictorial dot-probe task used by Bradley et al. (1998, 1999—see also Mogg & Bradley, 2002) was used in this experiment to gauge attentional biases towards different animals. In this task, two pictures appear on the screen (one on the left and one on the right) for a short period of time after which they vanish, revealing a probe behind one of the pictures. If the probe is ':' then the participant presses 'A' on the keyboard, but if the probe is '..' the letter 'L' is pressed. Reaction times to identify the probe, and errors made, were measured. By selecting different pairs of images these reactions can be used to see whether a person attended to one type of picture more than another. In the present case, there were two types of comparison: Pos-None (the animal associated with positive information paired with the animal associated with no information) and Neg-None (the animal associated with negative information paired with the animal associated with no information). If reaction times are faster when the probe appears behind the negative animal we can infer the child is looking at this animal in preference to the no-information control animal.

For each animal two different pictures were used, making 4 different combinations of pictures each for neg-none and pos-none trials. For a particular pair of pictures it was important to control for whether a particular picture appeared on the

left or right of the screen, therefore, each of these 4 different pictures pairs appeared twice: with the screen location for each picture being reversed. This results in 8 presentations for each type of pair. In addition, each of these 8 presentations had to be repeated with each of the two probes (':' and '..'), and each of these probes had to appear equally on the left and right of the screen. Therefore, in total, within each pair type there were 32 presentations, and because there were two types of pairing there were 64 presentations in all. Preceding the main trials, there were 24 practice trials in which reactions times were not measured.

For each presentation, a fixation cross appeared in the centre of the screen for 500ms, followed by the picture pair for 500ms, and immediately followed by the probe. Each picture was 400 × 400 pixels. The probe remained on the screen until the child pressed either 'A' or 'L' to identify the probe, and if the incorrect key was pressed an error was registered.

Procedure

The children were randomly allocated to a condition in which the dot-probe task was administered at the end of the experiment (No delay condition) or a condition in which the dot-probe task was conducted a minimum of 24 hours later (Delay condition). Within both of these groups children were further randomly allocated to one of three counterbalancing orders (the type of information given about the animal is in brackets): (1) Cuscus (negative), Quoll (positive), Quokka (no information); (2) Quokka (negative), Cuscus (positive), quoll (no information); and (3) Quoll (negative), quokka (positive), Cuscus (no information). Therefore, all types of information were associated with all animals across groups[i].

Each child was tested individually in a quiet room away from the rest of their class. They were shown the pictures of the three animals, and completed the FBQ.

The experimenter then read out the information about two of the animals (the order of positive and negative information was counterbalanced). Next, children completed the FBQ for a second time. Children in the no delay condition then did the visual dot-probe task. Children in the delay condition ended the experiment here and were not told they would be tested again; however, they were called back a minimum of 24 hours later and were given the visual dot probe task to complete. These children were not re-introduced to the animals. At the end of the first session all children were told not to discuss any aspect of the experiment with any other children[ii]. At the end of the experiment all children were debriefed and given specially designed activity sheets telling them about the Quoll, Quokka and Cuscus.

Results

A criterion for significance of .05 was used throughout unless otherwise stated, and effect sizes are reported as *r* where interpretable (i.e. for effects with one degree of freedom for the effect — see Field, 2005).

Self-report Measures

A 3 (type of information: negative, positive, none) × 2 (Time: before vs. after information) repeated measures ANOVA was conducted on the data. The type of information × time interaction violated the assumption of sphericity the ($\chi^2(2) = 10.53$, $p < .01$) so Greenhouse-Geisser corrected *F*-values are reported (Field 2005).

The crucial type of information × time interaction was significant, $F(1.68, 85.72) = 11.47$, $p < .001$ indicating that the change in fear beliefs over time was dependent on the type of information provided. Bonferroni corrected contrasts compared the change in fear-beliefs for valenced information compared to no information. These revealed a significant increase in fear beliefs after negative information compared to no information, $F(1, 51) = 9.61$, $p < .01$, $r = .40$ and a significant decrease in fear

beliefs after positive information compared to no information $F(1, 51) = 4.38$, $r = .28$. This shows that the fear information had the desired (and well-replicated) effect.

Dot-Probe Data

Trials on which children pressed the incorrect key were excluded because on these trials, children incorrectly identified the probe. Data were log-transformed to reduce the biasing effect of extreme reaction times. A 2 (type of trial: neg-none, pos-none) × 2 (Location of Valenced Picture: left vs. right) × 2 (Location of Probe: left vs. right) repeated measures ANOVA was conducted. If a person has an attentional bias, then when the valenced picture and the probe are the same side of the screen then reaction times should be faster than when they are on opposite sides. As such, this would be shown by a significant location of valenced picture × location of probe interaction. In addition, if the bias is different for negative stimuli, then this will be shown by a three way type of trial × location of valenced picture × location of probe interaction. This interaction was significant, $F(1, 48) = 7.50$, $r = .37$. To tease apart this interaction Bonferroni *t*-tests were performed. These tests showed that in negative-no information trials, when the probe appeared on the left reaction times were significantly faster when the negative pictures were also on the left compared to when the negative pictures were on the right, $t(49) = -2.18$, $r = .30$. However, when the probe appeared on the right of the screen there was no difference in reaction times regardless of where the negative pictures were, $t(49) = 0.34$, $r = .08$. For the positive-no information trials, when the probe appeared on the left reaction times were marginally significantly slower when the positive pictures were also on the left compared to when the positive pictures were on the right, $t(49) = 1.47$, $p = .07$, $r = .17$. When the probe appeared on the right of the screen there was no significant difference in reaction times regardless of where the positive pictures were, $t(49) =$

0.02, r = .02. These findings indicate the predicted attentional bias, but only when the probe appeared on the left hand side of the screen. The four-way trial × location of valenced picture × location of probe interaction × delay interaction was not significant $F(1, 48) = 1.76$, r = .19, indicating that the bias was not significant affected by whether the dot-probe task was carried out immediately or one day after the information.

In a separate analysis, because the ages were significantly different in the delay and no delay conditions, age was entered as a covariate. It had no significant effect and did not significantly interact with any other variables or interactions (all Fs (1, 47) < 1).

Do Fear Beliefs Mediate Attentional Biases?

Although the fear information must be responsible for the attentional bias observed (without the information, the analysis above should not yield differences because there is no such thing as a 'negative' animal), it is possible to see whether the degree to which fear beliefs changed mediates the observed bias. Judd, Kenny and McClelland (2001) suggest that in repeated measures designs such as those used here, mediation can be demonstrated by the two conditions. First, differences between reaction times to probes appearing behind a valenced stimuli should be different to those appearing beyond a non-valenced stimuli and changes in fear beliefs for the valenced stimuli should be different to those for the non-valenced animal. The direction of these differences should be consistent. Second, when the difference in reaction times is regression on both the difference between fear beliefs for the valenced and non-valenced animal and the sum of these fear beliefs, the difference in fear beliefs should predict the difference in reaction times.

This analysis was done first for the attentional bias in the left visual field for the negative animal. The analysis above showed that reaction times were different when the probe appeared behind the negative animal compared to the no information animal. What is more, the differences in the change in fear beliefs for the negative animal were significantly larger than for the no information animal, $t(50) = 3.15$, $r = .41$. Finally, when the difference in reaction times was regressed on the difference in fear beliefs, and the sum of fear beliefs for the negative and no information animals, the difference in fear beliefs significantly predicted the difference in reaction times, b (SE) = 0.032 (0.015), $t(47) = 2.13$. As such, the change in fear beliefs did mediate the attentional bias to negative information.

This analysis was repeated for the attentional bias in the left visual field for the positive animal. The analysis above showed that reaction times were almost significantly different when the probe appeared behind the positive animal compared to the no information animal. What is more, the differences in the change in fear beliefs for the positive animal were significantly smaller than for the no information animal, $t(50) = -2.05$, $r = .28$. However, in the regression analysis, the difference in fear beliefs did not significantly predict the difference in reaction times, b (SE) = 0.033 (0.022), $t(47) = 1.51$. As such, the change in fear beliefs did not mediate the attentional bias to positive information, although this finding is not surprising given the weakness of the original bias.

Discussion

This experiment has shown that negative information is sufficient to induce attentional biases towards a threatening stimulus (and partially supports a bias away from positive animal stimuli). What is more, the extent to which fear information changes fear beliefs mediates the magnitude of the induced bias. This finding is an

important step towards understanding the mechanisms underlying how negative verbal information can contribute to fear acquisition. Induced attentional biases have been shown to causally influence anxiety (Mathews & MacLeod, 2002) and the current results imply that negative information may contribute to developing anxiety through creating such a bias. However, the present results themselves do not indicate that anxiety increased: just that an attentional bias was induced and that the bias to negative stimuli was mediated by the extent to which fear information was successful in changing fear beliefs. The second important finding was that a delay between the information and measurement of the attentional bias did not significantly influence its size. This suggests that the induced bias was not merely a short-lived product of the initial manipulation of verbal information.

Although the attentional bias was present only in the left visual field and this may, at first, seem to weaken the overall findings, this observation is consistent with other research using the visual dot-probe task. For example, Mogg & Bradley (1999, 2002) found attentional biases only in the left visual field to rapidly-presented masked threat faces. Such findings are not surprising given that a left visual field bias implies right hemisphere involvement, and this hemisphere plays an important role in processing of emotional stimuli: the right parietal region of the brain appears to be involved in the perception of emotional cues (regardless of whether the emotional cue is positive and negative) and left and right frontal regions appear to be specialised for processing of certain positive and negative emotions respectively (see Davidson, 1992 for a review). Likewise, the right hemisphere appears to have an advantage over the left hemisphere in tasks in which emotional stimuli (faces specifically) have to be discriminated (Stone, Nisenson, Eliassen & Gazzaniga, 1996).

However, the present study does not tell us about the nature of the observed attentional bias. There are three slightly differing views of the role of attentional bias

to threat stimuli. The *biased attentional direction* and *shifted attentional function* explanations (Wilson & MacLeod, 2003) both agree that threat-related stimuli have a special propensity to attract visual attention processing. However, biased attentional direction explanations assume that threat stimuli attract attention only in anxious individuals whereas shifted attentional function explanations (e.g. Mogg & Bradley, 1998; Mogg et al., 2000) assume that all people (not just high anxious) direct attention to high intensity threat stimuli, and shift attention away from mild threat stimuli (but anxious individuals have a lower threshold for deciding whether a stimulus is a 'high intensity threat'). A third view of Fox, Russo, Bowles, & Dutton (2001) suggests that in anxious individuals threatening material does not capture visual attention any more quickly, but that once captured, it *holds* attention: anxious individuals cannot disengage attention from threatening material.

Mogg et al. (2000) and Wilson and MacLeod (2003) have adapted the dot-probe task by manipulating the threat intensity of stimuli and found evidence supporting the shifted attentional function view. However, Fox et al. (2001) have argued that tasks like the dot-probe do not allow conclusions about whether threat stimuli attract attention, or simply hold attention once detected because the task involves two pictures competing for attention. Using a variation of an exogenous cuing task Fox et al. elegantly showed that high anxious participants do fail to disengage from threat stimuli. Clearly the present study does not disentangle these views (and was not intended to), but future research does need to address whether negative information creates faster detection of the negative stimulus or a failure to disengage from the negative stimulus once detected, and whether this bias is moderated by trait anxiety levels.

Another issue is why information creates an attentional bias. In Mathews and MacLeod's (2002) model if a stimulus matches information associated with threat, it

will receive greater activation from a threat evaluation system and, therefore, greater attention. In the current study the negative information simply imbues a particular animal with threatening properties and so when it is evaluated it activates the threat evaluation system and is given more attention than the non-threatening control stimulus. In fact, the data showed that the extent to which negative information imbued an animal with threatening properties directly mediated the extent to which it captured attentional resources. This is not earth-shattering; however, what is surprising is that a relatively short burst of fact-style information in children can imbue a novel animal with threatening properties sufficient to activate the threat evaluation system, even a day after the information is given. In terms of how actual fear might develop, there are two possibilities: the information itself is sufficient to create anxiety, or, the acquisition of an attentional bias will, over time, incubate anxiety. The first possibility is partially supported by Field & Lawson's (2003) findings that children take longer to approach an animal following negative information about that animal. However, they did not measure actual anxiety. The second possibility is supported by research showing that induced attentional biases foster anxiety (e.g. Mathews & Macleod, 2002). Ongoing work is attempting to disentangle these possibilities.

The extent to which positive information reduced fear beliefs about an animal did not affect performance on the dot-probe task. As such, the mediating effect of verbal information on attentional bias was specific to negative information. The selective effect of negative information is consistent with Mathews and MacLeod's (2002) model, which suggests a system specifically designed to detect threat. It is also consistent with contemporary models of fear acquisition that propose an evolved fear module that selectively and automatically processes fear input (e.g. Öhman and Minkeka, 2001).

Finally, this experiment has shown how attentional bias can be created in normally developing children. Although Mathews and MacLeod (2002) and Mathews and Mackintosh (2000) have shown that such biases can increase anxiety in previously non-anxious individuals, it is worth speculating on what factors might determine whether a bias such as the one induced in the current study leads to anxiety. Lonigan, Vasey, Phillips and Hazen (2004) have suggested that temperamental factors such as negative affectivity/neuroticism have both a direct link to anxiety but also lead to anxiety through attentional biases. Therefore, one possibility is that the attentional bias induced by negative information may have a particularly profound effect (in terms of both the magnitude of the induced bias and the anxiety caused by having the bias) in children high on negative affectivity, neuroticism or even behavioral inhibition.

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Appendix A: Information

Positive Information

Have you ever heard of a cuscus/quoll/quokka? Well, cuscuses/quolls/quokkas come from Australia. They are small and cuddly and their fur is really soft. They are very friendly, and live in the park, where they love playing with children and the other animals. If you went to the park, a cuscus/quoll/quokka might come out to see you, and you could stroke and cuddle it. Cuscuses/Quolls/Quokkas eat berries and leaves, and you could feed it out of your hand, which would make it so happy. Everyone in Australia loves cuscuses/quolls/quokkas and they like people too.

Negative Information

Have you ever heard of a cuscus/quoll/quokka? Well, cuscuses/quolls/quokkas come from Australia. They are dirty and smelly and carry lots of germs. They are very dangerous, and live in dark places in the woods, where they hunt other creatures with their long sharp teeth and claws. Cuscuses/Quolls/Quokkas eat other animals, so their favourite food is raw meat and they like to drink blood. If you went to the woods, a cuscus/quoll/quokka might be hiding there, and you might hear its ferocious growl. I don’t know anyone in Australia who likes cuscuses/quolls/quokkas.

Appendix B: Questions for the Fear Beliefs Questionnaire

1. *Would you be happy to have a cuscus/quoll/quokka for a pet or look after a cuscus for a few weeks?
2. Do you think a cuscus/quoll/quokka would hurt you?
3. *Would you go up to a cuscus/quoll/quokka if you saw one?
4. Would you go out of your way to avoid a cuscus/quoll/quokka?
5. *Would you be happy to feed a cuscus/quoll/quokka?
6. Would you be scared if you saw a cuscus/quoll/quokka?
7. *Would you be happy if you found a cuscus/quoll/quokka in your garden?

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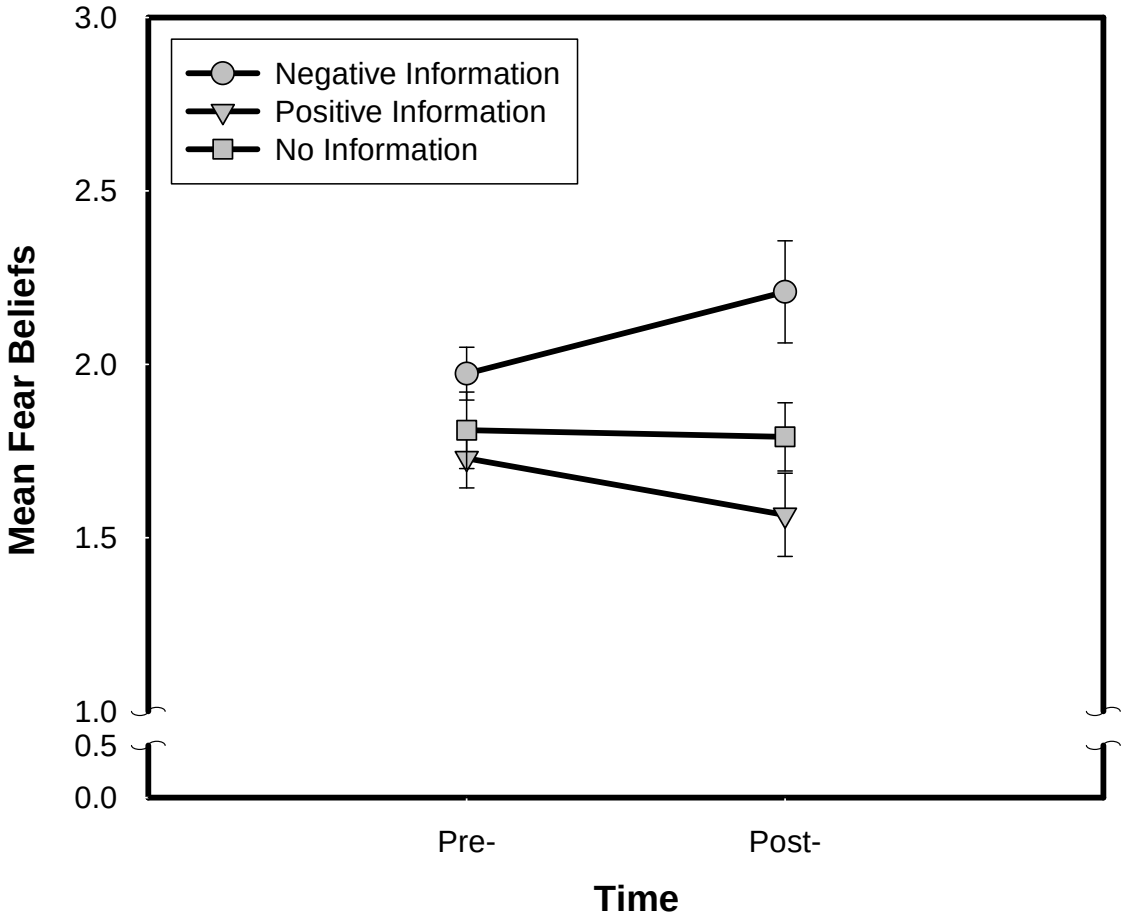
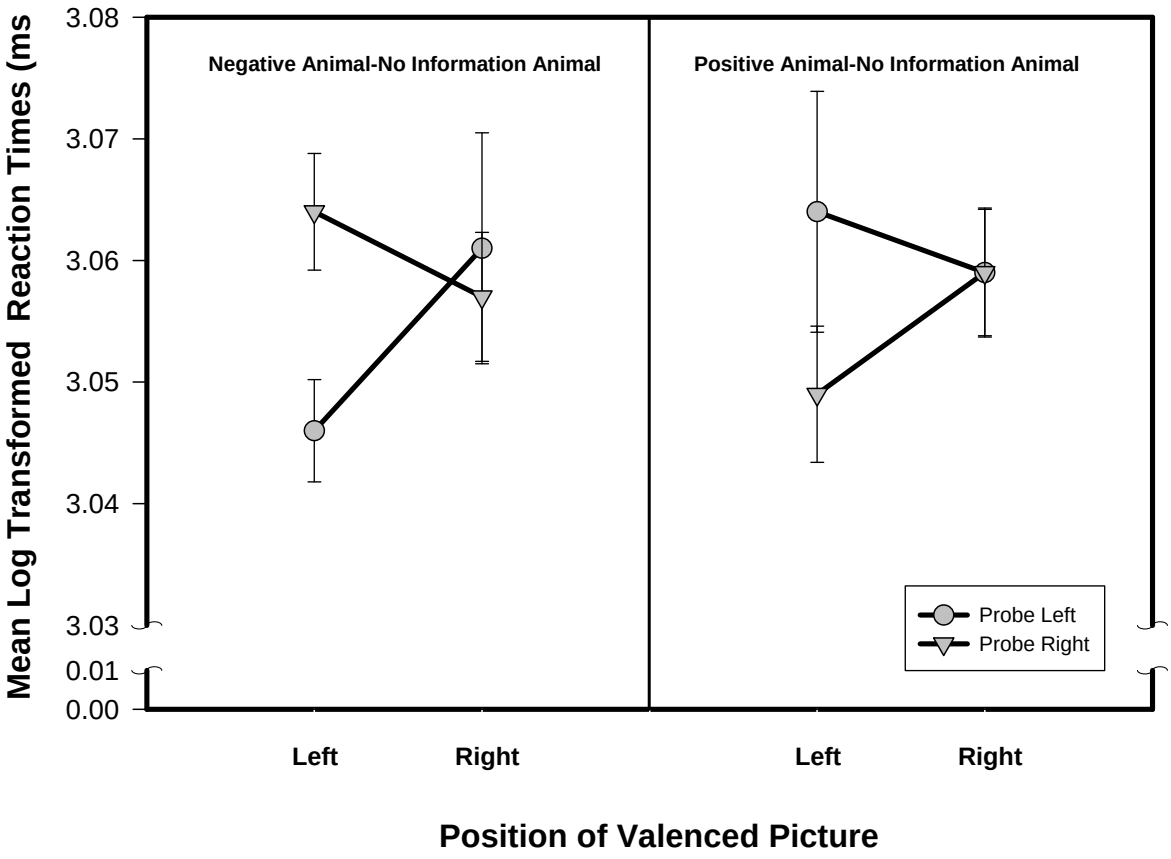
FIGURES

- Figure 1: Shows the mean fear beliefs (and standard error) before and after different types of information..
- Figure 2: Shows the mean log-transformed reaction time to respond to probes when they appeared on the left and right of the screen and when emotional pictures were on the left or right of the screen.


3.0
2.5
2.0
1.5
1.0
0.5
0.0
Mean Fear Beliefs
Negative Information
Positive Information
No Information
Pre-
Post-
Time



Footnotes

[i] This counterbalancing enables us to be certain that any attentional biases observed are not products of the animals used, but are induced by the information associated with the animals.

[ii] Although the need to randomly allocated children to experimental conditions (rather than assigning different classes to each condition) made it impossible to guarantee that children did not discuss the task (and hence prompt the children in the delayed condition about the task ahead) the likely potential bias was minimised because: (a) children in the delayed group did not know they would be called back for a second test; (b) the exact visual probe task experienced by children depended on the counterbalancing order to which they

were assigned. Therefore, even if children did defy their instructions and discuss the task, this would only advantage the children in the delayed group if they spoke only to children assigned to the same counterbalancing group. Discussing the experiment with other children would, if anything, reduce the effects because they would discover that other children received information conflicting with the information they personally received.